K.7

EUMETSAT POLAR !SYSTEM

GROUND SEGMENT

EPS PHASE A

OPERATIONAL METEOROLOGY

MISSION OBJECTIVES AND END

USER REQUIREMENTS DOCUMENT

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1 INTRODUCTION

1.1 Purpose

This document defines the operational meteorology mission objectives and user requirements for the EUMETSAT Polar System (EPS) Ground Segment It has been produced from a consolidation of pre-phase A and associated studies (RD1, RD2 and RD3) and provides the basic requirements for the development and operation of the EPS Ground Segment. The purpose of this document is to define requirements. References to how these will be achieved are the subject of the System Requirements Document and have thus been excluded from this document. Cross references within the document are shown using square brackets.

1.2 Scope

The requirements, which are stated explicitly in section 6, are arranged in a structure which represents their hierarchy. The aim is to ensure that, as far as possible, each requirement is defined only once and that interrelationships between requirements are visible. Six categories of capability requirement and four categories of constraint requirement have been identified. These are as follows:

Capability:
- General System
- Level 1b data
- Level 2 data
- Archive
- User service
- ARGOS / S&R / SEM

Constraint:
- Timescales
- Multi-satellite
- Community
- Evolutive

Each of these categories has a small number of top level requirements which are in turn subdivided into subsidiary requirements. The scope of this document limits the breakdown to four or in some cases five levels. This degree of breakdown is not considered to be exhaustive and further analysis and definition will be required before the document represents a comprehensive basis for a definitive SRD.

1.3 Overview

The principal objective for the EPS ground segment is to provide quality controlled data from imagery and sounding instruments operating in a polar orbit to the meteorological centres of the EUMETSAT member states, to NOAA and to the WMO weather forecasting centres. These data are required to meet the operational needs of NWP models as well as synoptic analyses and climate studies. Consequently the provision of these data needs to be both timely and continuous.

EPS, together with NOAA, forms part of an integrated system of meteorological polar satellites with

EPS in the morning orbit and NOAA in the afternoon orbit The development and operation of the EPS and NOAA ground segments will thus require close coordination.

1.4 Status of document

This document is a consolidation of pre-phase A and associated activities It forms a basis for agreement with the STG and for ongoing industrial studies. Changes to this document will be controlled by EUMETSAT.

1.5 Definitions

The following table provides definitions of data processing levels for those levels referred to in this document.

LEVEL	DEFINITION OF LEVEL
0	BASIC BIT STREAM FROM THE OBSERVING SYSTEM
1A	INSTRUMENT DATA IN FULL RESOLUTION, RECONSTRUCTED AND REDUNDANCY REMOVED. RADIOMETRIC AND GEOMETRIC CALIBRATION COMPUTED AND APPENDED BUT NOT APPLIED TO LEVEL 0 DATA.
1B	CALIBRATED, EARTH LOCATED AND QUALITY CONTROLLED DATA IN THE ORIGINAL PIXEL LOCATION. UP TO THIS STAGE, THE DATA ARE STILL REVERSIBLE.
2	EARTH LOCATED PIXEL VALUES CONVERTED TO GEOPHYSICAL PRODUCTS
3	GRID POINT GEOPHYSICAL PRODUCTS

1.6 Strum of document

The document consists of four main sections following the list of applicable and reference documents. The first of these, section three, examines the background to the EPS programme. It describes the EPS programme and its position within the Meteorological community (with brief reference to the Climatological community) under the following sub-sections:

- Meteorological satellite data requirements and the EPS contribution to them.
- Possible and desirable enhancements to EPS
- Complementary contributions to data needs from other satellite sources

Section four sets out the EPS Mission Objectives, detailing the main missions that the EPS ground segment will be developed to handle. In summary, these are:

- Global Data Access Mission
- Regional Data Access Mission

- Local Data Access Mission
- Data Location and Collection
- Pre-operational Missions
- Search and Rescue Missions
- Space Environment Monitoring Mission

Section five provides a general description of the users and their operating environment. Included in this section are an assessment of user characteristics and an examination of the assumptions and dependencies relating to the operation of the ground segment.

The final section, section 6, presents the user requirements defined to date, covering both capability and constraint requirements. This is the definitive list of requirements within this document, superseding any implied requirements in the earlier text.

2 DOCUMENTS

2.1 Applicable

2.2 Reference

RD1 EPS DATA AND PRODUCTS WORKING GROUP, FINAL REPORT, E-T, EUM/EPS/REP/91/1, March 1991.

RD2 EPS GROUND SEGMENT: END USER REQUIREMENTS, Issue 2, Matra-Marconi / Meteo France. CMS:DEMOS.EPS.92.0, 13 August, 1992

RD3 EPS GROUND SEGMENT: END USER REQUIREMENTS, Rev. 3, Thomson-CSF / UKMO, EPS/UKM/1000/TN/011, 14 August, 1992

3 EPS PROGRAMME BACKGROUND

3.1 The EPS Mission

The operational data required from polar orbiting satellites by the meteorological community are provided by an infrared radiometer, two infrared sounders, microwave sounders for temperature and humidity, a space environment monitor, a search and rescue package and a data collection system. For over 30 years, these requirements have been met by a system of satellites in sun-synchronous orbit, procured and operated by NOAA. This system includes two satellites with similar payload complements, one maintained in a morning orbit and the other in an afternoon orbit. This provides six hourly, full global coverage for the meteorological user community.

In the past, NOAA has operated both morning and afternoon satellites. The last NOAA satellite in the morning orbit is scheduled for launch in 1996. Ml subsequent NOAA polar satellites will be in the afternoon orbit. The purpose of EPS is to assume responsibility for the morning orbit following the retirement of the last NOAA morning satellite. As a result, EPS and NOAA form two parts of one system and there are thus a number of user requirements to ensure that they are coordinated. European users require data of the same quality and type, irrespective of which satellite they originate from.

Data from imagery and sounding instruments have been distributed from NOAA satellites for many years. The current series only serves the needs of the operational meteorologist in a limited way. Substantially improved services will be needed to satisfy the needs expressed by the European meteorological community and recorded in this document for future years.

The primary operational missions proposed for EPS are cloud imagery and the sounding of vertical profiles of atmospheric temperature and humidity. The basic operational meteorology instruments are described in the following list. Each instrument is shown with its NOAA predecessor, which in some cases may be used if the new instrument is unavailable.

VIRSR / AVHRR	Visible IR Scanning Radiometer. Cloud imagery. Seven spectral channels of radiometric data in the form of crosstrack scanned digital image data.
MTS / AMSU-A	Microwave Temperature Sounder. Provides microwave temperature sounding with six additional channels in the 60-63 GHz region for soundings in the 45-72km region of the atmosphere.
MHS / AMSU-B	Microwave Humidity Sounder.
IRTS / HIRS	IR temperature sounder provides IR temperature data.
IASI	It is planned to add the IR Atmospheric Sounding Interferometer, a medium spectral resolution IR spectrometer. to provide moisture and temperature soundings in the troposphere and lower stratosphere with new levels of accuracy and vertical resolution together with measurements of column

integrated or profiles of key tropospheric compounds like 0, CO, CH_4, N_2O and SO,

Basic information on the instrument characteristics and the means of broadcast dissemination used is given in the following table:

OPERATIONAL DATA SOURCES			DATA SERVICES		
INSTRUMENT		DATA RATE (kbps)	LRPT VHF	HRPT S-BAND	GLOBAL X-BAND
VIRSR / AVHRR	Visible and scanning infra-red radiometer	(High) 1,044		•	•
		(Low) 42	•		
IRTS / HIRS	Infra-red temperature sounder	3.5	•	•	•
MTS / AMSU-A	Microwave temperature sounder	1.5	•	•	•
MHS / AMSU-B	Microwave humidity sounder	4	•	•	•
IASI	Infra-red advanced sounding instrument	1,500		•	•
SEM	Space Environment Monitor	0.16	•	•	•
S&R	Search and rescue				
ARGOS	Data location and collection package	2.6	•	•	•
MCP House-, keeping data		2	•	•	•
MCP Admin message.		15	•	•	•

3.2 EPS Data and Product requirements

3.2.1 Expected contribution of EPS to meteorological requirements

This section summarises the information which the meteorological community would like to receive or derive from EPS. The EPS instruments from which the information will be derived are shown in the right hand column.

1. Basic Atmospheric Fields (in three dimensions)

Cloud Motion Winds (polar)	VIRSR/AVHRR
Temperature	IASI, MTS/AMSU-A, IRTS/HIRS, VIRSR/AVHRR
Relative humidity	IASI, MTS/AMSU-A, IRTS/HIRS, VIRSR/AVHRR
Cloud liquid water content	MTS/AMSU-A, MHS/AMSU-B
Cloud particle size and phase	
Column ozone	IRTS/HIRS, IASI
Aerosol concentration	

2. Atmospheric Discontinuities

Boundary layer top (level and temperature)	
Tropopause (level and temperature)	

3. Cloud Parameters

Cloud imagery	VIRSR/AVHRR
Cloud top pressure & temperature	IRTS/HIRS, VIRSR/AVHRR
Cloud cover and classification	IRTS/HIRS, VIRSR/AVHRR
Cloud reflectivity	IRTS/HIRS, VIRSR/AVHRR
Radiation budget	

4. Surface fields

Precipitation	MTS/AMSU-A, MHS/AMSU-B
Surface pressure	
Surface contact temperature	VIRSR/AVHRR, IASI
Ocean wave spectrum	
Albedo	IRTS/HIRS, IASI
Snow depth	VIRSR/AVHRR, MTS/AMSU-A, MHS/AMSU-B (cover)
Sea-ice, thickness	VIRSR/AVHRR, MTS/AMSU-A, MHS/AMSU-B (extent)
Soil moisture	MTS/AMSU-A, MHS/AMSU-B
Vegetation	VIRSR/AVHRR

3.2.2 Desirable enhancements of EPS instrumentation

The previous section listed the contribution of the basic EPS instrument set to meteorological satellite data requirements. This section examines enhancements which would contribute to the areas least well covered by the EPS baseline. In relation to the currently proposed payloads then? are two possible enhancements.

- On board calibration should improve the quality of visible products from VIRSR / AVHRR.
- Detailed information on the microwave antenna patterns (MHS / AMSU-B, MTS / AMSU-A) should improve the Earth location of the data and the collocation of instruments for synergistic use.

3.2.3 Relevance of other space&aft and other contributions

The data from EPS may be complemented by data from a number of sources. These include:

- **Imagery** available from geostationary satellites at high temporal resolution from MSG and complementary missions operated by NOAA and NASDA.
- Advanced sounders, such as AIRS, flown cm polar missions operated by NASA
- Missions intended for measuring trace gasses and other variables of importance to understanding the climate and-environment, such as ENVISAT etc.

In particular, the following pre-operational instruments will, subject to status, complement the data from EPS instruments (cf pre-operational requirements table in section 6)

ATSR	Precision SST
MIMR	Sea surface wind speed, Cloud liquid water, Precipitation, Soil moisture
SSM/I	Precipitation
CERES	Radiation budget
SCARAB	Radiation budget
ERBE	Radiation budget
TOMS	**Ozone**
SBW	Trace gasses / ozone
GOME	Ozone
WMOS	Trace gasses
SCIAMACHY	Trace gasses / temperature

HIRDLS	Stratospheric chemistry
AMAS	Trace gasses / temperature
ASCATT	Surface stress
RA	Wave characteristics
(Rain Radar	Precipitation)[1]
(ATLID	3d winds)
(ALADIN	3d winds)

[1] **Brackets** indicate future instruments of potential interest to operational meteorological users

4 EPS MISSION OBJECTIVES

4.1 Global data access mission

The global data from meteorological satellites in polar orbit must be made available to the meteorological services within the timeliness requirements for NWP. Full resolution global data will be provided by on-board storage combined with dumping to ground via X-band. There are three main categories within the global data access mission. These are now summarised in turn.

4.1.1 Global operational sounding

In order to forecast the weather, meteorologists require a complete description, at regular intervals (at least every 6 hours) of the current state of the atmosphere. The NWP models use vertical profiles of temperature and humidity as basic quantities for the fundamental equations used in these numerical models. Therefore there is a requirement for measurements of the temperature and humidity of the atmosphere at many levels from the surface to the stratosphere Increasingly, the sounding data are used in the form of brightness temperature values, The objective of the EPS Global Sounding mission is to provide continuity from the existing provision of global data with equivalent instruments while providing increased horizontal and vertical resolution where possible. Global Operational Sounding will involve the supply of data from the MHS / AMSU-B, MTS / AMSU-A and IRTS / HIRS instruments. IASI provides improvements in the height resolution of temperature and humidity profiles which will increase their value to forecasters considerably_

4.1.2 Global operational imagery

At present, global image data are provided by the NOAA AVHRR instrument. The objective of the EPS Global Imaging mission is to continue the provision of these data, using VIRSR / AVHRR to improve accuracy without compromising data continuity. The data are used for cloud detection, but also for estimates of sea surface temperature, radiation budget and support to the sounding missions.

4.13 Data collection and location mission

Ocean buoys and similar Data Collection Platforms (DCPs) are a key source of global in-situ observational data_ Satellites provide an important data communications capability for such DCP. This mission is currently provided by the ARGOS system on both the NOAA morning and afternoon satellites. ARGOS will also be included in the EPS payload_ It receives data broadcast by remote data collection units on the Earth. These data are collected for later transmission to the ARGOS ground station as well as re-broadcast in real time for use by distributed ground receivers_

4.2 Regional data access mission

A number of European users require access to sounding, imaging and in-situ data with similar characteristics to those. specified for global data, but for a limited regional area. This is particularly true for EUMETSAT member states, many of whom will require data for coverage of Europe and its approaches, including the Eastern Atlantic, the Middle East., North Africa, Northern Scandinavia

and the Arctic regions.

4.3 Local data access mission

The polar satellites orbit the Earth every 100 minutes approximately. The Local Data Access Mission requires that the satellites transmit sounding, imaging and -in-situ data so that any authorised ground station in any part of the world can receive local data when the satellite is visible from it. The satellites are in view of the receiving station for 10 to 15 minutes of each visible orbit.

4.3.1 High Resolution Picture Transmission (HRPT)

The HRPT direct broadcast service will provide all of the instrument data available at full resolution as well as duplicating the LRPT. This service will be a packetised digital data stream at approximately 35 Mb/s.

4.3.2 European HRPT network for regional coverage

To support short term and regional forecasting in Europe, meteorological centres would benefit from receiving data from an area covering the Atlantic, within 30 minutes of observation. This area is larger than one satellite ground terminal's zone of coverage and would thus require an HRPT network and with additional coordination, processing and dissemination of these data to be coordinated from the EPS ground segment.

4.3.3 Low Rate Picture Transmission (LRPT)

The current APT and TIP real-time data links will be replaced by one digital link labelled LRPT. The LRPT will contain any three of the seven VIRSR / AVHRR channels, selected via ground command, combined with data from the low rate instruments in a packetised digital data stream.

4.4 Pre - operational products access mission

Pre-operational data from instruments on the ESA, NASA and NASDA missions will be of value to many operational meteorological users. The objective of this mission is to distribute pre-operational instrument data to meteorological users.

45 Search and rescue mission

The Search and Rescue transponder is used to locate aircraft and ships in distress and hence direct the rescue services.

The S&R system is a totally independent system that receives distress messages from Emergency Position Indicating Radio Beacons (EPIRBs) carried by ships and Emergency Location Transmitters (ELTs) carried by aircraft and relays distress messages to the Search and Rescue coordinating centres. Only housekeeping and telemetry data are routed via the EPS data system.

4.6 SEM mission

Space Environment Monitoring is used by NOAA to support a warning service to Astronauts of dangerous solar events and also to act as a satellite environment monitor in support of system / subsystem failure analysis. EUMETSAT needs to monitor the performance of the operational instruments in the space environment and understand any problems in the context of variations in radiation at the location of the satellite. The SEM capability will thus be available on EPS.

5 USER ENVIRONMENT

5.1 user characteristics

5.1.1 Classification of users

A range of categories of users have been defined for the EPS ground segment The classification is based on the nature of the data application and the scale of the meteorological operation. Primary, Secondary and Local users are all considered to be components of the worldwide meteorological community, while the category of external users represents the wide range of non-meteorological users, still to be fully defined, who will require access to EPS data. The value of the classification is that it allows consideration of the different levels at which users will interface with the EPS ground segment and the Likely number of users at each level. For example, it is likely that primary users will generally if&face at a low level while local users will normally require high level products. The general structure of the classification in terms of data access is given in Figure 1:

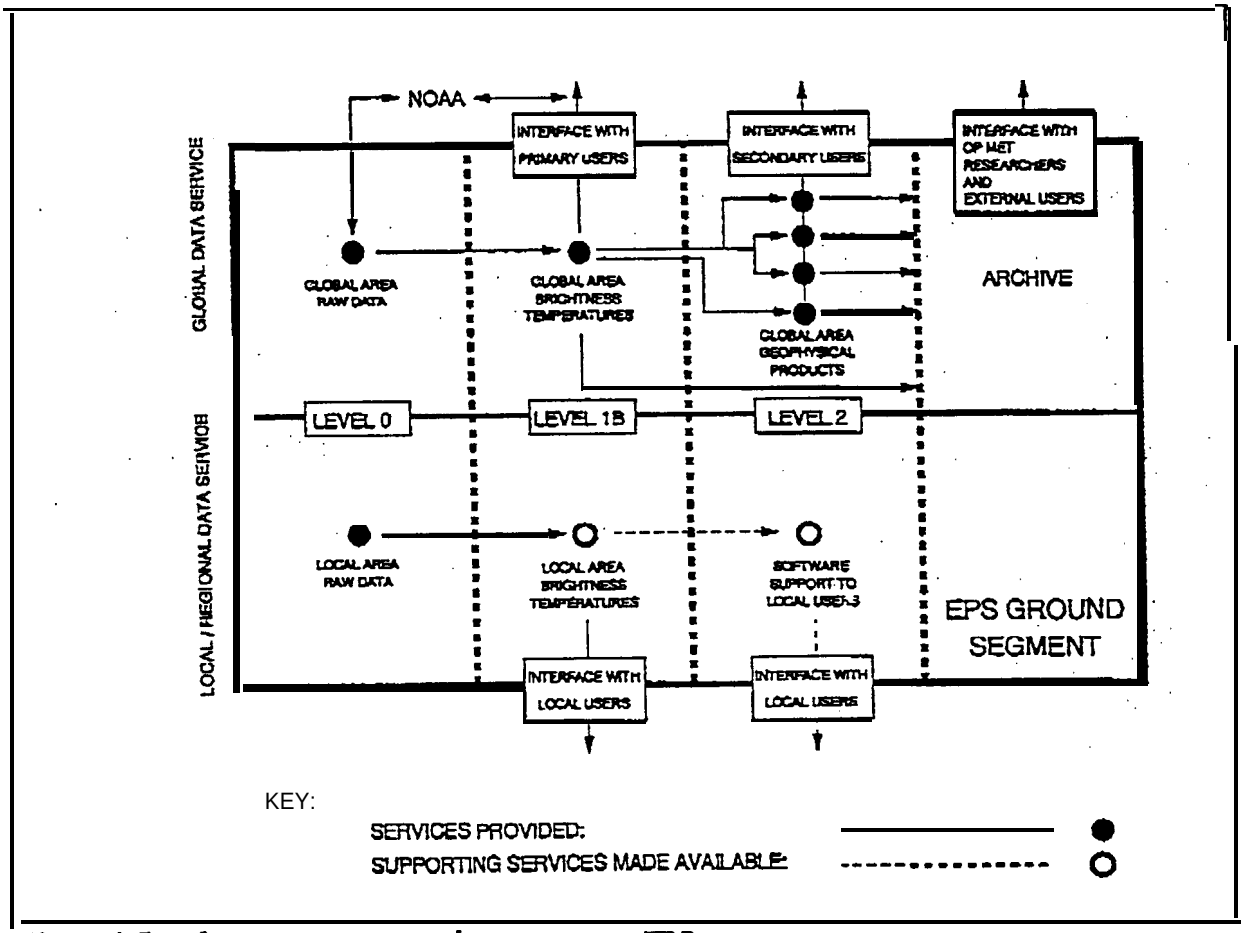

Figure 1: Interfaces to user categories within the EPS ground segment

5.1.1.1 Primary users

This group consists of centres which run operational NWP models to produce global forecasts. It includes the WMCs and some RSMCs, using the WMO classification. Centres in Europe considered as primary users are:

Bracknell
Offenbach
Toulouse
ECMWF

These users will require full resolution global data as level lb for input to NWP assimilation schemes. They will also require global level 2 products generated by the EPS ground segment.

5.1.1.2 Secondary users

There are a number of National Meteorological Services which operate regional forecasting systems, but which do not operate global NWP systems with full assimilation schemes. Within this category, two types of user are defined on the basis of their data requirements. These are:

- European Secondary Users. These are principally EUMETSAT member sates with regional forecasting centres which require timely delivery of full resolution level lb' data with regional coverage direct from EPS (4.2). In some cases, analyses from primary centres are used as a basis for local and regional forecasts.

- World Weather Watch users. These require some regional level lb data and regional and global level 2 products, which will be transmitted to them over the GTS with reduced spatial resolution.

5.1.1.3 Local users

These are distributed globally and have LRPT and / or HRPT terminals to receive direct broadcast data. Today, the number of HRPT users is more than 100 and growing. These users are generally small forecast offices, often subsidiaries of the main national centres. Other users, such as transport and water authorities, also fall within this category.

5s.l.4 ESA

ESA requires access to the global data to support processing of their part of the payload complement.

5.1.1.5 External users

These include user groups outside the mainstream meteorological system. An examples within the

broader European Earth observation community would be the ESA Earthnet system. These users will generally use the data from archive for research purposes rather than directly for operational use. Other users who require routine access to data would obtain this from their national meteorological service.

5.12 User application categories

In parallel with the classification of user groups expressed above, it is important to consider the basic applications for which the data and products from EPS are intended_ These are expressed below.

5.1.2.1 NWP systems

NWP systems perform numerical solutions to the basic equations of atmospheric behaviour in order to move an initial atmospheric state forward in time for a required forecast period. The definition of the initial condition is achieved through a data assimilation phase in which data from a variety of sources are assimilated into a model grid on the basis of observation quality and location. The assimilation phase incorporates earlier model forecast data to ensure that the initial atmospheric state is numerically stable. It is normally undertaken 2 or 4 times per day, at 00h, 12h and possibly 06h and 18h.

NWP systems contribute to forecasting at a range of temporal and spatial scales from long term global models (approx 100 km, 10 days) to mesoscale models (> 10 km, about 12 hours upwards). It is important to note the need for satisfactory boundary conditions in regional and mesoscale models. This is often achieved by model nesting, with boundary conditions from a primary user often being used by regional models at a number of secondary user centres. NWP models also require data on land and sea conditions to define the lower boundary condition.

Satellite data, from both polar and geostationary sources, provide data with a high spatial and temporal resolution. These provide an excellent complement to the but highly localised measurements from sources such as radiosondes and wind profilers.

There are four levels at which EPS data can contribute to NWP systems. These are as follows.

- Direct assimilation of data with relatively little processing into NWP models. Examples include radiances or, equivalently, brightness temperatures. Level lb data are required.

- The direct assimilation of data with significant amounts of processing, including the combination of data at different times or from different channels. Examples include cloud motion vectors, temperature profiles and surface temperatures. Level 2 data are required.

- Assimilation of a field of data determined from the analysis by an expert. This is a product derived from satellite data, but differing from it in containing manual input. In most cases such a field could not be determined automatically using current methods or data. An example is the use of satellite imagery and an appropriate conceptual model by a *forecaster to* estimate humidity profiles below and within cloud layers.

- The assimilation of products derived objectively using combinations of satellite and in-situ data. Examples include cloud top height (combining information about the temperature at the top of a cloud with that about the temperature profile of the atmosphere from a model), or the derivation of a field of the height of the cloud base by the interpolation of observations using satellite images.

5.123 Nowcasting and short range forecasting (<12hrs) systems

Forecasts for periods up to 12 hours are based on direct extrapolations of current meteorological conditions. The forecasts are generally at high resolutions for local areas. A major source of data for these forecasts is weather radar, which is currently blended with data from geostationary satellites which have a high temporal resolution_

Sounding, imagery and in-situ observations from EPS will be available through HRPT and LRPT for nowcasting. These observations can be used each time the orbit allows the area of interest to be viewed. With both the EPS and NOAA satellites, repeat coverage will be achieved every 6 hours. Although coverage from orbits either side are likely to be of value, the temporal separation between data inputs means that the value of EPS data for Nowcasting would be improved by using geostationary satellites to provide some degree of time interpolation.

Nowcast users with HRPT or LRPT stations will have access to software and the information necessary to allow the processing of the raw data to level lb. This software will be regularly maintained to ensure consistency with central processing facilities.

Applications of nowcasts and short range forecasts include the following:

Detection of convection, fog St and SC over the sea.
Forecasting frost / fog.
Forecasting preferred areas of convection over land_
Detection of precipitation (and rough estimation of intensity)
Estimation of precipitation accumulation (3 - 12 hrs)
Fog and low level cloud at night
Aircraft icing
Combinationof satellite data with other data in order to derive imagery for use in KBS
Snow / no snow over land and ice / no ice over sea

5.1.2.3 Climate and environment studies

Studies of climatic and environmental changes require highly accurate and consistent long term records of atmospheric as well and land and ocean parameters. Consistency over time and space is much more important than high resolution, although regional variations, such as urban heat islands and local sea level variations are important to the study of environmental change.

5.2 Operational environment

52.1 Interfaces with external systems

The following interfaces with external systems are required:

- EPS space segment for input of data to the EPS ground segment and for dissemination of raw data to users.
- NOAA-NESDIS to obtain satellite data and products from NOAA satellites.
- METEOSAT product extraction facility
- WMO GTS for product dissemination to WWW users and receipt of ancillary data for quality control

5.2.2 Link with MSG ground segment

The geostationary and polar meteorological satellites provide complementary data. The polar observing system provides better calibration and a more elaborate sounding system with a 6 hour repeat cycle for global data. The geostationary system provides a more frequent (15 minutes) repeat cycle for regional observations. Data from these two sources have traditionally been treated separately, with data fusion occurring at the application level. The concurrent planning of the EPS and MSG ground Segments offers the opportunity to develop combined, or at least coordinated processing procedures.

Possible examples of interrelationships include:

- Cross calibration of the two systems
- MSG may distribute some EPS derived products <such as polar wind mosaics)
- MSG may use EPS radiance data to produce an MSG product
- MSG may use a derived product from EPS
- Use of MSG data to fill in time gaps of EPS for nowcasting and accounting for diurnal dependenceof parameters such as clouds

6 CAPABILITY AND CONSTRAINT REQUIREMENTS

This section defines a set of user requirements for the EPS Ground Segment. The stated requirements are supported by the information in chapters 1 to 5 which provide a background to the requirements, state the **mission objectives** and define key terms. Specific d&&ions are referred to the appropriate section using square brackets, eg [4.1].

The requirements stated below supersede any requirements implied by the earlier chapters. As far as possible, overlaps between requirements have been minimised, leading to a set of **exclusive** requirements.

A numbering scheme has been adopted which reflects the hierarchy of requirements. Within this hierarchy, each requirement is subdivided into component requirements which express the next level of detail. There is thus traceability from the high level mission statements to the detailed requirements upon which the SRD will be built. In each case, a letter is used to indicate whether the requirement is mandatory (M), conditional (C) or desirable (D). These designations also reflect the hierarchy so that there can be a desirable aspect of a mandatory requirement or a mandatory aspect of a desirable requirement, should it be included. A conditional requirement (C) is considered to be mandatory (M), but subject to external constraints.

The structure shown in Figure 2 has been adopted for the statement of requirements. This chapter is divided into the sections in Figure 1 with the addition of two appendices. The appendices cover the product requirements (level 2 data) for EPS operational instruments and general pre-operational instruments respectively. They have been separated for clarity, but remain an integral part of the requirements. In each section the first statement gives the top level user requirement from which the subsidiary requirements follow. For the top two levels of requirement, summary headings have been used as a guide.

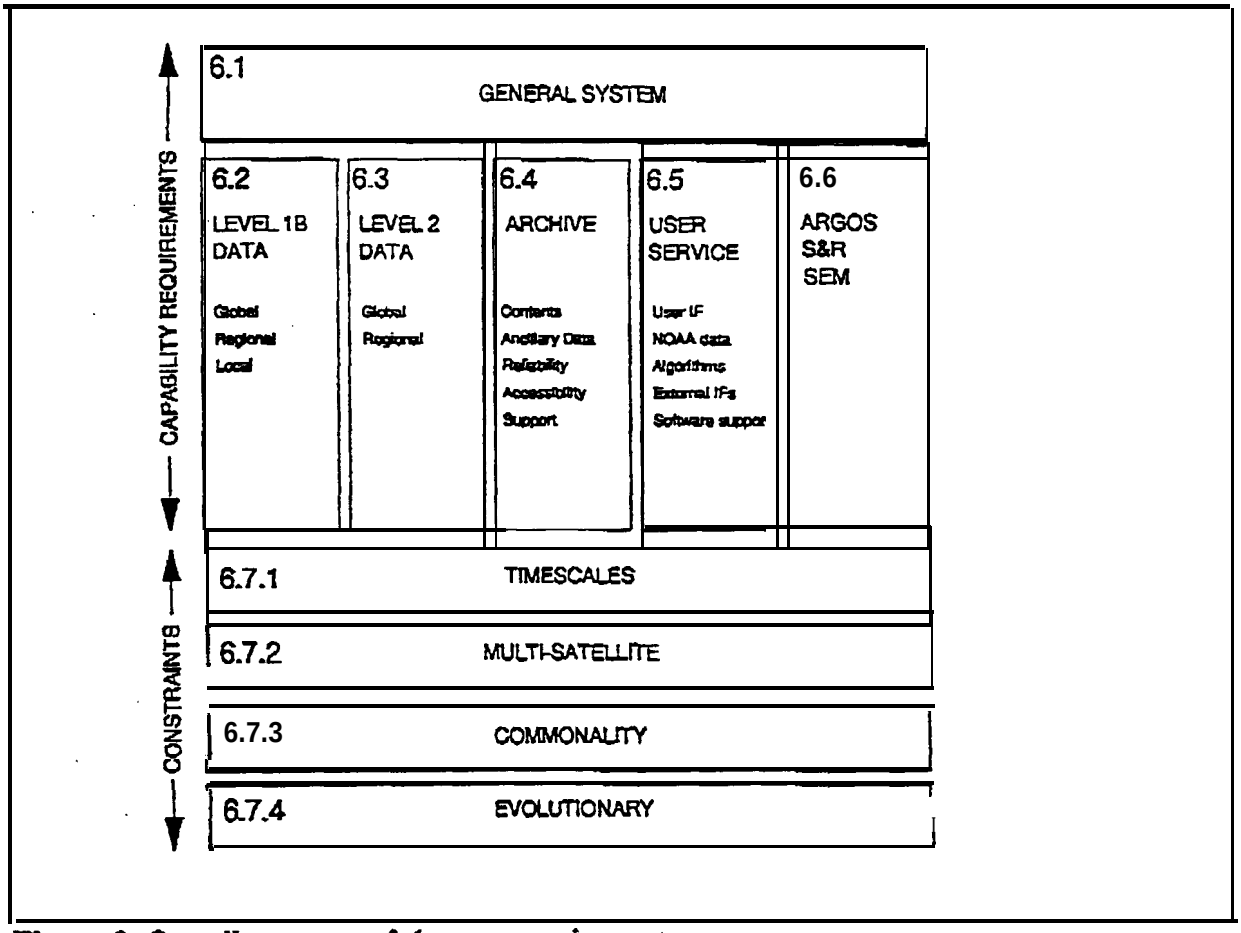

Figure 2: Overall structure of the user requirements

6.1 GENERAL SYSTEM REQUIREMENTS

6.1.1 (M) The European meteorological community shall have access to global observations of the atmospheric state made by EPS.

6.1.2 (M) There shall be an EPS ground segment to provide users with coordinated access to a range of data and products from both the EPS and NOAA satellites.

6.1.3 (D) It is important that the EPS be seen in the context of the total meteorological observing system consisting of in situ, ground based, geostationary and polar orbiting components.

6.2 LEVEL 1B DATA REQUIREMENTS

62.1' (M) Global requirements [4.1]

Global level 1b data [1.5] shall be made available to primary users [5.1.1.1] from both the morning and afternoon satellites through the EPS ground segment.

6.2.1.1 (M) Sounder data [4.1.1]: Primary users require sounder data with the following characteristics:

6.2.1.1.1 (M) Primary users shall receive global level lb data for each channel of the IRTS / HIRS, MTS / AMSU-A and MHS / AMSU-B sounding instruments.

6.2.1.1.2 (M) Primary users shall receive global level 1b data from the advanced IR sounding instrument IASI.

6.2.1.1.3 (M) The data shall be provided at maximum spatial resolution.

6.2.1.1.4 (M) The data shall be made available to the primary users within 2 hours of observation.

6.2.1.2 (M) Image data [4.1.2]: Primary users require image data with the following characteristics.

6.2.1.2.1 (M) The data shall be calibrated, Earth located and quality controlled (level 1b) global data from VIRSR / AVHRR in the form of brightness temperatures or reflectance (depending on the channel).

6.2.1.2.2 (M) The data shall be provided at maximum spatial resolution.

6.2.1.2.3 (M) The data shall be made available to the primary users within 2 hours of observation.

6.2.1.3 (M) Navigation control: Earth location and navigation shall be performed. These are particularly important because of the need to combine instrument data.

6.2.1.3.1 (M) Localisation errors shall be equal to or better than those in the following table:

	ABSOLUTE ACCURACY		RELATIVE
	VIRSR	SOUNDER	VIRSR/S'DER
GLOBAL NWP	< 5 KM	< 5 KM	1 KM
CLIMATE / REM. SENSING	1 KM	< 5 KM	1 KM
SHIPPING / AVIATION	< 5 KM	< 5 KM	1 KM

6.2.1.3.2 (C) The localisation of the imager VIRSR / AVHRR shall be checked routinely (by automatic comparison of the imagery to know cloud free coastal land-marks).

63.1.4 (M) Instrument performance and calibration: High calibration accuracy shall be maintained and careful monitoring of the methods used to calibrate the data (both on-board and on the ground) shall be undertaken.

6.2.1.4.1 (M) The EPS ground segment shall ensure the correct operation of the instruments and monitor their performance.

6.2.1.4.2 (M) Raw brightness temperature production shall remain dependent only cm engineering considerations (i.e. independent of any geophysical input apart from ephemeris parameters).

6.2.1.4.3 (D) Calibration and navigation data and associated quality control information ought to be available in a standard software format

6.2.1.4.4 (D) There ought to be standardisation of data structures for level 1b data and derived products with appropriate modules for conversion of numerical counts into brightness temperatures (with up to date non linearity corrections if necessary).

62.15 (M) Quality control: Data quality control (both on-board and on the ground) shall be undertaken during the generation of the level lb data.

. 6.2.1.5.1 (M) Quality control shall be performed within the timeliness requirements for the data.

6.2.1.5.2 (M) Information on the error estimation and a quality flag shall be added to the data delivered to the primary users together with the level lb data.

6.2.1.53 (D) Support data relating to the derivation and quality control of level lb global data ought to be delivered to the users together with the level lb data.

6.2.1.5.4 (C) Off-line trend / bias analysis shall be performed using independent reference data.

6.2.1.6 (M) Algorithms: Algorithms shall have the following characteristics.

62.1.6.1 (C) The algorithms used to derive level lb data shall be identical between NOAA and EUMETSAT.

6.2.1.6.2 (M) Primary users shall be able to request and recommend controlled modifications to algorithms used within the EPS ground segment to generate and quality control level lb data.

6.2.1.6.3 (D) It ought to be possible to reverse the processing undertaken to convect raw data to level lb data,

6.2.1.7 (M) Continuity of supply: An uninterrupted 24 hour data supply is required throughout the year. In the event of system degradation, the following guidelines shall apply.

6.2.1.7.1 (M) The flow of regional level lb data shall be maintained even in delayed mode, with the discipline attached to real time processing.

6.2.1.7.2 (M) When recovering from system failure, priority shall be give&to the most recent data, transmitting older data as time allows. No data shall' be considered too old to process.

6.2.1.73 (D) Data from ocean areas adjacent to Europe ought to be given priority during system recovery.

6.2.1.7.4 (C) Reductions in service due to maintenance shall be controlled and users informed in advance.

6.2.2 (M) Regional requirements [4.2]

Regional level lb data shall be made available to European Secondary Users [5.1.1.2] through the EPS ground segment. Regional data are a geographical subset of the appropriate global dataset. The following specific characteristics are required by regional users in addition to the global level 1b data requirements stated above.

6.2.2.1 (D) Timeliness: The regional data ought to be made available to European Secondary users with minimal delay.

6.2.2.2 (D) **Resolution: Full** resolution data are required.

6.23 (C) **GTS requirements** [5.1.1.2]

A reduced resolution global data set from the morning satellite shall be provided via the **GTS. This shall operate within the** scheduling constraints of the GTS.

6.2.4 **(M) Local** requirements [4.3]

Data shall be made available to local users via the EPS satellite's communication facilities HRPT and LRPT [3.1: 'Data services']. Information to allow the processing of local data to level. 1b shall also be made available.

6.2.4.1 (C) **Sounder data: Local users shall be** able to receive all local data in a raw form via the HRPT / LRPT

6.2.4.2 (C) **Image data:** Local users shall be able to receive all local data in a raw form via the HRPT / LRPT.

6.2.4.3 (C) **In-situ data:** Local **users** shall **be** able to receive in-situ data via the direct broadcast service.

6.2.4.4 (C) **Navigation control: Earth location** and navigation data shall be provided to local users via the direct broadcast service.

6.2.4.4.1 (M) There shall be a supply of data to enable local users to achieve localisation errors equal to or better than those in the following table:

	ABSOLUTE ACCURACY		RELATIVE
	VIRSR	SOUNDER	VIRSR/S'DER
NOW&STING	1 KM	< 5 KM	1 KM
SHIPPING / AVIATION	< 5 KM	< 5 KM	1 KM

6.2.4.42 (C) The localisation of the imager VIRSR / AVHRR shall be checked routinely by automatic comparison of the imagery to known cloud free coastal land-mark

6.2.4.5 (M) **Instrument performance and calibration: High caliion** accuracy shall be maintained and careful monitoring of the methods used to calibrate the data shall be undertaken.

6.2.4.5.1 (D) The time varying parameters and coefficients needed to calibrate and locate the instrument data correctly ought to be made available to users via the direct broadcast service.

6.2.4.6 (C) **Algorithms:** A set of software shall be available from the EPS to local users to enable them to deliver level lb data from raw data streams.

6.2.4.6.1 (C) The local level lb data processing software shall be regularly maintained by EPS to ensure that it is up to date with the global level 1b processing system.

6.2.4.6.2 (C) It shall be possible to reverse the processing undertaken to convert raw data to level 1b data using the supplied algorithms.

6.2.4.7 (M) Continuity of supply: An uninterrupted service is required during periods when the satellite is within reception range of the local user's ground station.

6.2.4.7.1 (D) Reductions in service due to maintenance ought to be controlled and users informed in advance.

6.2.4.7.2 (D) If data cannot be received in real time for any reason, they should be available in slower time from the EPS ground segment.

6.3 LEVEL 2 DATA REQUIREMENTS

Geophysical products shall be produced and made available to users at level 2 [IS]. The requirements for specific product types are described in Appendix A. The categories considered for each product are:

- Priority
- Coverage
- Frequency
- Accuracy
- Instrument source(s)
- Specific quality control
- Horizontal and Vertical resolution
- Timeliness

Each product type has been allocated a requirement number which is given in the first column of the table. The products are listed in approximate order of priority within the following groups

- Basic atmospheric parameters
- Cloud parameters
- Ocean parameters
- Land surface parameters
- Radiation budget / ozone

The requirements which follow apply to all centrally derived products.

6.3.1 (M) **Algorithms:** The optimal algorithms for deriving 'tie meteorological products listed, in Appendix A from the basic satellite observations within the EPS ground segment shall be developed in cooperation with research institutes and experienced meteorological services

6.3.1.1 (D) Details of algorithms and associated maintained software ought to be made available to users.

6.3.2 (M) **Quality control:** Quality control of centrally generated meteorological products is required, both during product production and in the form of long term trend analysis.

6.3.2.1 (M) A quality flag [specification TBD] shall be appended to each of the products.

6.3.2.2 (C) The meteorological fields used to derive and check the global EPS and NOAA products shall be made available to users.

6.3.3 (C) Product distribution: Centrally derived products (or a subset of these) shall be

made available to users.

633.1 (D) These ought to use what will be existing data dissemination networks as far as possible. Examples of such networks include the GTS and MSG data circulation.

6.3.4 (D) Product exchange: There is a requirement for telecommunication arrangements with ESA, NASA and NASDA facilities so that pre-operational satellite instrument products may be made available to European meteorological users through the EPS ground segment as the opportunity arises.

6.3.4.1 (C) EPS users require fast delivery products from pre-operational instruments on board planned ESA missions. These products are listed in the table in Appendix B.

6.4 ARCHIVE REQUIREMENTS

The EPS ground segment shall undertake data archiving and provide access to archived data for EPS users.

6.4.1 (M) Contents: Users require the archive to contain the following types of information with associated durations.

6.4.1.1 (M) Global level lb data for every orbit from EPS shall be stored with associated data including telemetry, calibration and quality control information. These data shall be kept indefinitely.

6.4.1.2 (M) All algorithms, associated software and parameter / coefficient tables used for deriving level lb and level 2 data shall be stored indefinitely.

6.4.1.3 (C) Global NOAA level lb data from every orbit shall be stored for 1 month from reception on a rolling basis.

6.4.1.4 (D) All global and regional level 2 products from EPS and NOAA derived within the EPS ground segment as defined in Appendix A. These should be stored indefinitely with quality control information_

6.4.2 (M) Ancillary data: The data in the archive shall be accompanied by metadata. This will include the following:

6.4.2.1 (M) Error estimation and quality flags.

6.422 (M) Telemetry, calibration, and quality control information.

6.4.2.3 (C) In-situ observations, analyses and forecast fields used in the quality checking, calibration and processing shall be stored in the archive.

6.4.2.4 (C) Long term trend data describing the performance of operational instruments shall be stored.

6.43 (M) **Reliability:** There is a requirement for long term reliability in the storage of archived items. Failure rates in archived items shall not exceed TBD %

6.4.3.1 (D) The EPS ground segment needs to ensure that degradation of the archive does not occur.

6.4.4 (C) Accessibility: Data shall be available from the archive on a range of media as well as via computer to computer links. Access to data shall depend on the type and age of the data as follows.

6.4.4.1 (D) Response within 3 hours to global level lb data and level 2 products from EPS and NOAA of the current day.

6.4.4.2 (D) Response within 24 hours for the last month of global level lb data and level 2 products from EPS and NOAA.

6.4.4.3 (D) Response within 1 week for global raw EPS data and NOAA / EPS products older than 1 month corresponding to short periods of time (ie up to a few days).

6.4.4.4 (D) Response within 1 week for global raw EPS data and NOAA / EPS products older than 1 month corresponding to longer periods of time (> a few days). This will include:

6.4.4.4.1 (D) Extraction of limited areas of level lb or 2 data for campaigns.

6.4.4.42 (D) Long time series of specific product requirements at global or regional scale.

6.4.4.4.3 (D) Access to NOAA level lb data older than 1 month.

6.4.5 (M) **Support facilities:** The archive shall be supported by the following facilities:

6.4.5.1 (C) Quick look for EPS and NOAA to aid the selection of cl& areas (cloud mask requested) or special cloud patterns (visible and IR images needed)

6.452 (C) A log book recording the following information:

6.4.52.1 (M) Ground system status for EPS.

6.4.5.2.2 (C) Ground system status for NOAA.

6.453 (C) A catalogue as defined under user services [6.5.1.2].

6.5 USER SERVICE REQUIREMENTS

Services shall be provided to assist users of the data through a single point of contact for all information required. All information about the EPS shall be accessible by the user to support both operational applications and research.

6.5.1 (M) User interface: There shall be a user interface which will support the following functions

6.5.1.1 (M) An information service for EUMETSAT member states and NWP centres with regard to the EPS operations. This will include the transmission of administrative messages via direct broadcast containing the following types of information:

6.5.1.1.1 (M) Notification of time varying coefficients and parameters.

6.5.1.1.2 (M) Advance warning of service interruptions including major system upgrades, what and when they are and what effect they will have on the user.

6.5.1.2 (C) A catalogue system to guide the user to the EPS data wherever they are held. This will include the following:

6.5.1.2.1 (M) Information to assist users with access to all forms of information held in the archive.

6.5.1.2.2 (M) Orbital parameters for all tie EPS orbits available at the EPS ground segment.

6.5.1.2.3 (D) Information to assist users with access to NOAA data including raw data older than 1 month.

6.5.1.2.4 (D) Orbital parameters for all the NOAA orbits available at the NOAA ground segment.

6.5.1.2.5 (C) Information on pre-operational data within the EPS ground segment.

6.5.1.3 (M) A single point of contact for user requests for access to current and archived data.

6.5.1.4 (D) Users ought to be able to access the centrally maintained and documented software and utilise it within their own software.

6.5.1.4.1 (D) Users ought to be able to create jobs which will access the on-line data or request data from archives, then perform the required

calculations on the central site and return the results or data sets to the user's home site.

6.5.1.4.2 (D) **Users** ought to be able to save temporary files in the central site **for** later processing.

6.5.1.5 (C) Response to user queries on data flow and data quality.

651.6 (C) Long term trend analysis of instruments and processing shall be available to users.

6.5.2 (C) **Algorithm availability:** The algorithms used for product generation shall be made available to users. [6.2.1.6, 6.2.4.6]

653 (D) **Other** external **interfaces:** Information on data / products and interfaces to other systems including **ESA, NASA,** and NASDA products and their data handling systems ought to be available. This must permit interoperation.

6.5.4 (D) Research **facility:** There ought to be a research facility to assist users in the interpretation and validation of EPS data_ This will provide:

654.1 (D) Central computing facilities accessible to authorised users

6.542 (D) Centrally maintained and documented software

6.5.4.3 (D) Personnel to provide meteorological support and advice an the use of the facilities

6.6 ARGUS / S&R / SEM MISSION

The EPS ground segment shall support a data collection system, a search and rescue mission and a space environment monitor.

6.6.1 (M) Data collection and location system [4.5]: The EPS ground segment shall support the ARGOS system.

6.6.1.1 (M) Ensure that operation of the system is maintained and that the housekeeping and telemetry data are provided to NOAA

6.6.2 (M) Search and Rescue [4.6]: The EPS ground segment shall support the Search and Rescue system.

6.62.1 (M) Ensure that the data are collected and disseminated in a timely manner.

6.6.3 (M) SEM [4.7]: SEM data shall be received by the EPS ground segment and transmitted to NOAA.

6.7 CONSTRAINT REQUIREMENTS

6.7.1 Timescales: The following timescales shall apply to the EPS ground segment.

6.7.1.1 (M) The ground segment **shall** be ready, accepted and operational by **EPS** launch.

6.7.1.2 **(M)** The ground segment **shall** operate **continually throughout the** operation of the **EPS.**

6.7.2 Multisatellite: The **EPS** ground **segment** shall have the **following characteristics.**

6.7.2.1 (M) **The EPS Ground Segment shall be able to handle data from all the operational instruments** for **all** space **platform configurations and to** cope with different **formats.** When new spacecraft are **introduced they** should be **introduced** via a **pre-operational phase** overlapping with **current systems.**

6.7.2.2 **(M)** The **EPS** ground segment **software** shall be able to handle both morning and afternoon spacecraft telemetry formats during the **transition** phase **during** which different formats might be used_

6.7.3 **Commonality:** The following commonality **requirements apply:**

6.73.1 **(D)** **There** ought to be **coordination** of algorithms and software for a range of basic **processing** and **quality** control **procedures.** This **shall address** continued **compatibility** of methods between the **EPS ground segment, EUMETSAT** member state **centres,** NOAA and WMO.

6.73.2 **(D)** **Compatibility** with existing NOAA **systems:** The **dissemination** services used with **EPS** ought to be **compatible** with those used with the **existing** NOAA **polar** system.

6.7.3.3 (C) Compatibility with **planned** NOAA satellites There **shall** be **commonality** with NOAA This **concerns** the following areas:

6.7.3.3.1 (C) **Pre-processing** software and formats up to level lb brightness temperatures.

6.7.3.3.2 (C) Data **processing** software.

6.7.3.3.3 (D) The **algorithms** chosen for the derivation of products **ought** to be **selected** and implemented **in** coordination with **NOAA. Future developments shall** also be coordinated **in** this way.

6.7.3.3.4 (C) Compatibility of the direct broadcast users' service and support to the derivation of level lb data.

6.7.3.3.5 (C) Coordination on archive access and catalogues.

6.7.3.4 (D) MSG **compatibility** There ought to be compatibility with MSG to facilitate combined use of data. This shall apply in the following areas:

6.7.3.4.1 (M) There is a specific need to complement cloud motion winds from geostationary satellites with cloud motion winds for the polar cap regions based on imagery from successive orbits of the EPS.

6.7.4 Evolutionary system: User requirements will change in areas such as required products and the best algorithms to use.

6.7.4.1 (M) The system shall be able to evolve to meet these need while maintaining an operational status.

6.7.4.2 (M) All changes to the operational system shall be subject to change control procedures.

6.7.4.3 (M) Production software shall be subject to continued development in areas where performance targets are not achieved, even when data become operational after launch.

APPENDIX A PRODUCT REQUIREMENTS

The tables in this appendix list the specific requirements for level 2 products, including climate requirements. Each product group has a requirement number prefixed with a P. The requirements have been divided into application areas as follows:

Atmospheric Parameters	P1 to P7
Cloud Parameters	P8 to P13
Ocean Parameters	P14 to P15
Land Surface Parameters	P16 to P21
Radiation Budget / Ozone	P22 to P23

Within each group, the requirements from three sources are given together for comparative purposes. The three sources[2] are:

M Matra-Marconi / Meteo-France End User Requirements (RD1)
T Thomson-CSF / UK Met Office End User Requirements (RD2)
D Data and Products Working Group: Final Report (RD1)

The requirements from each source have been placed together as a basis for discussion. Requirements where there is variation between the sources have been highlighted with shading.

The section on quality control is for specific product quality control requirements, most of which are still to be defined.

[2] The IASI interface specification has been used as input to the table. References to this specification are denoted by an I.

R#/S	Product name	Prio	Coverage	Frequency	Accuracy	Source	QC req'ts	X/Y res'n	Z res'n (local'n)	Application	Time
ATMOSPHERIC PARAMETERS											
P.1 D	Wind (cloud track vectors)	1	Regional / polar caps		5 m/s			100 km		NWP direct use	
T		1	Global & Regional		1-2 m/s if 2-3 m/s sl			40 km (geo) 20 km (pol)	0-2: 500m 2-15: 1km 15-30: 3km		6h
M		1	Polar caps	1 / orbit	5 m/s	VIRSR / AVHRR		40 km		NWP	2h
P.2 D	Thickness	1	Regional	3-6 hrs	0.5-1°C tr 1-2°C str			25 km	0-8: 1km 8-15: 2km 15-30: 3km	NWP / Nowcast	
			Global	3-6 hrs	0.5-1°C tr 1-2°C str			50 - 100 km	0-8: 1km 8-15: 2km 15-30: 3km		
T			Regional	6h (3h)	0.5-1°C tr 1-2°C str			25 km	0-8: 1km 8-15: 2km 15-30: 3km		6h
			Global	6h (3h)	0.5-1°C tr 1-2°C str			50 km	0-8: 1km 8-15: 2km 15-30: 3km		6h

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The section on quality control is for specific product quality control requirements, most of which are still to be defined.

[2] The IASI interface specification has been used as input to the table. References to this specification are denoted by an L

R#/S	Product name	Prio	Coverage	Frequency	Accuracy	Source	QC req'ts	X/Y res'n	Z res'n (local'n)	Application	Time
P.3 M	Temp sounding	1	Global	4 / day	0.5-1° tr 1-2° str	IASI, MTS / AMSU-A, IRTS / HIRS, VIRSR / AVHRR		45 km	0-8: 1km 8-15: 2km 15-30: 3km	NWP / ESA	2hr
I		1	Rogionnll		0.5 - 1° tr 1 - 2° str	IASI		25 km	0-8: 1km 8-15: 2km 15-30: 3km	NWP / Nowcasting	
			Global		0.5 - 1° tr 1 - 2° str	IASI		50 - 100 km	0-8: 1km 8-15: 2km 15-30: 3km	NWP / Climatology	
P.4 D	Relative humidity	2	Regional	1-3 hrs	10%			25 km	0-8: 1km 8-15: 2km 15-30: 3km	NWP	
			Global	3-6 hrs	10%			50-100 km	0-8: 1km 8-15: 2km 15-30: 3km	NWP	
M		1	Global	4 / day	10%	JASI, MTS / AMSU-A, IRTS / HIRS, VIRSR / AVHRR		45 km	0-8: 1km 8-15: 2km 15-30: 3km	NWP / ESA	2h

R#/S	Product name	Prio	Coverage	Frequency	Accuracy	Source	QC req'ts	X/Y res'n	Z res'n (local'n)	Application	Time
T		1	Global & Regional	dt = 6 hrs	10%			25 km @50°N @5 km @50N	0.25 1km 0.15 2km 0.30 2km		6h
I		2	Regional		10 %	IASI		25 km	0.2 500m 2.15 1km 15.30 3km	NWP	
		2	Global		10 %	IASI		50 - 100 km	0.2 500m 2 1hr 1km (5 30 3km	NWP	
P.5 D	Precipitation	4	Regional	3 hrs	0.25 %			10 km		Nowcast / NWP verif	
		4	Global	3-6 hrs	0.25 %			50 km		Hydrol. / Agric	
		4	Global	3-6 hrs	0.1 %			100 km		Climatology	
M		2	Global	4 / day	10 %	MTS / AMSU-A, MHS / AMSU-B		50 km	(< 5 km)	NWP verif'n	3hr
		4	Global	4 / day	10 %			100 km	(< 5 km)	Climatology	24hr
T	(rate)	4	Regional	4 / day	15-20 %			40 km			
		4	Global	4 / day	10 %			100 km			

R#/S	Product name	Prio	Coverage	Frequency	Accuracy	Source	QC req'ts	X/Y res'n	Z res'n (local'n)	Application	Time
P.6 D	Cloud liquid water content	2	Olobnl	3-6 hrs	0.01-0.02 mm			25-100 km	vertically integrated	NWP / Climatology	
M		2	Olobnl	4 / day	0.01 mm			50 km	(< 5 km)	ESA	3hr
		4	Global	4 / day	0.01-0.02 mm	MTS / AMSU-A, MHS / AMSU-B		100 km	(< 5 km)	Climatology	24hr
T		2	Global & Regional	dt = 6 hrs	0.01-0.02mm 0.02 mm			25 km regional 50 km global	vertically integrated		6hr
P.7 D	Tropopnuso Altitudo	4	Regional	3 hrs	1 km			10 km		NWP / Nowcast / Aviation	
			Global	3-6 hrs	1 km			50 km			
			Global	12 hrs	1 km			100 km		Climatology	
I		4	Regional		1 km	IASI		10 km		NWP / Aviation	
		4	Global		1 km	IASI		50 km		Nowcasting	
		4	Global		1 km	IASI		100 km		Climatology	

R#/S	Product name	Prio	Coverage	Frequency	Accuracy	Source	QC req'ts	X/Y res'n	Z res'n (local'n)	Application	Time
					CLOUD PARAMETERS						
P.8 M	Cloud flags	1	Global	4 / day				MHS / AMSU-B scale (TBD)		NWP	2hr
P.9 D	Cloud cover	2	Global	3-6 hrs	1/10 ±2°C tops			100 km		Climatology	
M		2	Global	4 / day	1/10	IRTS / HIRS, VIRSR / AVHRR		5 km	(< 5 km)	Aviation / ESA	3hr
T		2	Global / Regional	dt = 6 hrs	± 2°C / 1/10			10 km 100 km			6hr
M		4	Global	4 / day	1/10	IRTS / HIRS, VIRSR / AVHRR		100 km	(< 5 km)	Climatology	24hr
I	Cover / Classification	2	Global		1/10 ±2° tops	IASI		25 - 100 km		NWP / Climatology	
P.10 T	Fog location	3	Regional	3-6 / day	500 m 1°C			10 km			3-6h
P.11 D	Cloud top Height	3	Global	3-6 hrs	300 m			25-100 km		Climatology	

R#/S	Product name	Prio	Coverage	Frequency	Accuracy	Source	QC req'ts	X/Y res'n	Z res'n (local'n)	Application	Time
M	Cloud top temp	2	Global	4 / day	± 2°C	IRTS / HIRS, VIRSR / AVHRR			(< 5 km)	Aviation / ESA	3hr
	(& height)	4	Global	4 / day	± 2°C	IRTS / HIRS, VIRSR / AVHRR			(< 5 km)	Climatology	24hr
T	(freezing level)	3	Regional & Global	4 / day	500 m						6hr
	(height)	3	Regional	dt = 6 hrs	500 m 1°C					Monthly average for climate	6hr
	(type)	3	Global / Regional								6hr
I	(height)	3	Global		300 m	IASI				NWP / Climatology	
	(freezing level)	3				IASI				Nowcasting / Aviation / NWP	
P,12 D	Cloud type / phase	3	Global	3-6 hrs						Climatology	
M	Cloud phase and type	2	Global	4 / day					(< 5 km)	Aviation	3hr

R#/S	Product name	Rio	Coverage	Frequency	Accuracy	Source	QC req'ts	X/Y res'n	Z res'n (local'n)	Application	Time
		4	Global	4 / day				[illegible]	(< 5 km)	Climatology	
T		3	Rogional	4 / day				[illegible]			6hr
P.13 T	Cloud reflectivity	4				IRTS / HIRS, VIRSR / AVHRR					
M	/albedo	2	Global	4 / day	2%			50 km	(< 5 km)	ESA	3hr

R#/S	Product name	Prio	Coverage	Frequency	Accuracy	Source	QC req'ts	X/Y res'n	Z res'n (local'n)	Application	Time
				OCEAN PARAMETERS							
P.14 D	SST	2	Global	24 hrs						Climatology	
T		2	Global	dt = 6 hrs							24h 6h
M		3	Global	1 / day					(< 5 km)	NWP	24hr
		4	Global	4 / day					(< 5 km)	Climatology	24hr
		4	Global	1 / day					(1 km)	Remote sen.	24hr
I		2	Global			IASI				NWP	
		2	Global			IASI				Nowcasting	
P.15 D	Ice boundaries / sea ice extent	3	Regional	24 hrs				10 km		NWP / shipping	
		3	Global	24 hrs				50 km			
		3	Global	weekly				100 km		Climatology	
M		2	Global	1 / day				10 km	(< 5 km)	Shipping	3hr
		3	Global	1 / day				50 km	(< 5 km)	NWP	24hr
		4	Global	1 / week				100 km	(< 5 km)	Climatology	24hr

R#/S	Product name	Prio	Coverage	Frequency	Accuracy	Source	QC req'ts	X/Y res'n	Z res'n (local'n)	Application	Time
T		3	Global	1 / day	[illegible]			40 km 10km ideally		Shipping, NWP	

R#/S	Product name	Prio	Coverage	Frequency	Accuracy	Source	QC req'ts	X/Y res'n	Z res'n (local'n)	Application	Time
LAND SURFACE PARAMETERS											
P,16 D	Vegetation	4	Regional							Agriculture / NWP	
		4	Global							NWP	
		4	Global							Climatology	
M		3	Global			VIRSR / AVHRR			(< 5 km)	NWP	24hr
		4	Global			VIRSR / AVHRR			(< 5 km)	Climatology	24hr
		4	Global			VIRSR / AVHRR			(1 km)	Remote sen.	24hr
T		4	Regional		10-20%						
		4	Global		10-20%						
I		4	Regional			IASI				Agriculture	
		4	Regional			IASI				NWP	
		4	Global			IASI				NWP	
		4	Global			IASI				Climatology	

R#/S	Product name	Prio	Coverage	Frequency	Accuracy	Source	QC req'ts	X/Y res'n	Z res'n (local'n)	Application	Time
P.17 D	Snow cover	3	Regional	3 hrs	3 %					NWP	
		3	Global	3-6 hrs	3 %					Forecasting	
		3	Global	24 hrs	3 %					Climatology	
M		3	Global	4 / day		VIRSR / AVHRR, MTS / AMSU-A, MHS / AMSU-B			(< 5 km)	NWP	2hr
		4	Global	1 / day	3 %				(< 5 km)	Climatology	24hr
T		3	Global	3-6 / day	Edge 1 km cover 5%						3-6h
P.18 D	Albedo	3	Regional	24 hrs	2-3% rel			10 km		NWP Agriculture	
		3	Global	24 hrs	2-3% rel			50 km			
		3	Global	weekly	2-3% rel			100 km		Climatology	
M		3	Global	1 / day	2 - 3 %	IRTS / HIRS		50.km	(< 5 km)	NWP	24hr
		4	Global	1 / week	2 - 3 %	IRTS / HIRS		100 km	(< 5 km)	Climatology	24hr

R#/S	Product name	Prio	Coverage	Frequency	Accuracy	Source	QC req'ts	X/Y res'n	Z res'n (local'n)	Application	Time
		4	Global	1 / day		IRTS / HIRS		1 km	(1 km)	Remote sen.	-
T		3	Regional & Global	1 / week	±2-3% rel			40 km			
P,19 D	LST	4	Regional	3 hrs	1-2°C			10 km		Agriculture / NWP / Nowcast	
		4	Global	3-6 hrs	1-2°C			50 km			
		4	Global	3-6 hrs	0.5°C			100 km		Climatology	
M		3	Global	4 / day	1-2°C	VIRSR / AVHRR		50 km	(< 5 km)	NWP	2hr
		4	Global	4 / day	0.5°C	VIRSR / AVHRR		100 km	(< 5 km)	Climatology	24hr
		4	Global	4 / day		VIRSR / AVHRR		1 km	(1 km)	Remote sen.	24hr
T		4	Global / Regional	4 / day	0.5°C			40 km		Climatology	
		4	Global	4 / day	±1-2°C			40 km			
I		4	Regional		1 - 2°C	IASI		10 km		Agriculture	
		4	Global		1 - 2°C	IASI		50 km		Nowcasting / NWP	

R#/S	Product name	Prio	Coverage	Frequency	Accuracy	Source	QC req'ts	X/Y res'n	Z res'n (local'n)	Application	Tlmo
		4	Global		0,5°C	IASI		100 km		Climatology	
P.20 T	Soil moisture					MTS / AMSU-A, MHS / AMSU-B					
P.21 D	Mapped images		Global	3-6 hrs						Forecast j Aviation / Shipping	
M			Polar	4 / day					(< 5 km)	Forecast / Aviation / shipping	3hr
T			Regional & Global	4 / day	5%						

R#/S	Product name	Prio	Coverage	Frequency	Accuracy	Source	QC req'ts	X/Y res'n	Z res'n (local'n)	Application	Time
					RADIATION BUDGET / OZONE						
P.22 D	Radiation Data & Budget	3	Global	3-6 hrs	5 W/m²					Climatology / NWP	
M		4	Global	4 / day	5 W/m²	ERBE			(< 5 km)	Climatology	24hr
T		3	Global	4 / day	5 W/m²				-	NWP / Climatology	6hr
I		3	Global		5 W/m²	IASI				NWP	
		3	Global		5 W/m²	IASI				Climatology	
P.23 D	Ozone	5	Global	3-6 hrs	2 - 3 %			25 km		NWP / Climate / Env studies	
M		2	Global	4 / day	2 - 3 %	IRTS / HIRS		25 km	(< 5 km)	Forecast / NWP (Trop height)	2hr
		4	Global	4 / day	2 - 3 %	IRTS / HIRS		25 km	(< 5 km)	Climatology	24hr
T		3	Global	1 / day	2 - 3 %			250 km		Climate	24hr
I		5	Global		2 - 3 %	IASI		25 km		NWP / Climatology / Environment	

APPENDIX B PRE OPERATIONAL INSTRUMENTS

PRE OPERATIONAL INSTRUMENTS

	PRODUCT NAME	PRIO	AREAL COVER	FREQUENCY	ACCURACY	SOURCE	QC REQ'TS	X/Y RES'N	Z RES'N	USER LEVEL	TIME
T	3D WINDS					ATLID, ALADIN					
T	V HIGH RES SOUNDING					AIRS					
T	WIND SPEED OVER OCEANS					ASCATT, MIMR					
T	WAVE CHARACTERISTICS					RA (ERS-1)					
T	PRECISION SST					ATSR					
T	CLOUD LIQUID WATER					MIMR					
T	PRECIPITATION					MIMR, SSM/I, RAIN RADAR					
T	SOIL MOISTURE					MIMR					
T	RADIATION BUDGET					CERES, SCARAB, ERBE					
T	STRATOSPHERIC CHEMISTRY					HIRDLS					
T	TRACE GASSES					GOMOS, GOME, TOMS, SBUV, SCIAMACHY					

APPENDIX C ACRONYMS

ALADIN	Atmospheric Doppler Laser Instrument
AMSU	Advanced Microwave Sounder unit (A & B)
APT	Automatic Picture Transmission
ARGOS	Meteorological Data Collection and Location System
ASCATT	Advanced Scatterometer
ATLID	ATmospheric LIDar
ATSR	Along Track Scanning Radiometer
AVHRR	Advanced Very High Resolution Radiometer
CDA	Command and Data Acquisition
CERES	Climate and clouds and Earth's Radiant Energy System
DCP	Data Collection Platform
ECMWF	European Centre for Medium range Waether Forecasting
EPIRB	Emergency Position Indicating Radio Beacon
EPS	EUMETSAT Polar System
ERBE	Earth Radiation Budget Experiment
ESA	European Space Agency
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
GOME	Global Ozone Monitoring Experiment
GOMOS	Global Ozone Monitoring by Occultation of Stars
GOS	Global Observing System
GTS	Global Telecommunications System
HIRDLS	High Resolution Dynamic Limb Sounder
HIRS	High resolution InfraRed Sounder
HRPT	High Resolution Picture Transmission
IASI	Infrared Advanced Sounder Interferometer
IRTS	InfraRed Temperature Sounder
KBS	Knowledge Based System
LRPT	Low Rate Picture Transmission
MHS	Microwave Humidity Sounder
MIMR	Multiband Imaging Microwave Radiometer
MSG	Meteosat Second Generation
MTS	Microwave Temperature Sounder
NASA	National Aeronautics and Space Administration
NASDA	National Aeronautics and Space Development Administration
NESDIS	National Environmental Satellite Data and Information Service
NMC	National Meteorological Centre
NOAA	National Oceanic and Atmospheric Administration

RA	Radar Altimeter
RSMC	Regional or Specialised Meteorological Centre
SBUV	Solar Backscatter ultra Violet
SC	StratoCumulus
SCARAB	Scanner for Earth's Radiation Budget
SCIAMACHY	Scanning Imaging Absorption Spectrometer for Atmospheric Cartography
SEM	Space Environment Monitor
SRD	System Requirements Document
SSM/I	Special Sensor Microwave / Imager
SST	Sea Surface Temperature
STG	Scientific and Technical Group
TBD	To Be Determined
TIP	Tiros Information Processor
TOMS	Total Ozone Mapping Spectrometer
VIRSR	Visible InfraRed Scanning Radiometer
WMC	World Meteorological Centre
WMO	World Meteorological Organisation
WWW	World Weather Watch